Remarks

Amendment to the Claims

Claims 1, 4, 5, 7 to 9, 11 to 13, 15, 16, 18 to 20, 22 and 24 to 31 have been canceled. New independent Claims 32 and 33 have been added. Claims 2, 3, 6 and 10 are now dependent from Claim 32 and Claims 14, 17 and 21 are now dependent from Claim 33. Claim 23 remains as an independent use claim.

New Claim 32 covers a process for brewing beer comprising:-

fermenting anaerobically a broth using yeast to convert sugar into water, ethanol and carbon dioxide; and

removing directly carbon dioxide dissolved in the fermenting broth by diffusion for at least part of the process.

Support for this new claim can be found in Claims 1 and 9 as filed and in the description on page 1, lines 13 to 20.

New Claim 33 covers a process for reducing the level of foam generated during the brewing of beer comprising:

fermenting anaerobically a broth using yeast to convert sugar into water, ethanol and carbon dioxide, said carbon dioxide having a variable concentration in the broth; and

controlling the concentration of carbon dioxide dissolved in the broth to below saturation by removing directly carbon dioxide therefrom by diffusion for at least part of the process.

Support for this new claim can be found, for example, in original Claims 12, 13 and 20, and in the description on page 1, lines 13 to 20. Support for the term "a variable concentration" is implicit in the specification. The skilled person would readily appreciate that the fermentation takes place in a closed system and that the concentration of carbon dioxide in the broth will increase as the process proceeds in time from zero to saturation point.

Independent use claim, Claim 23, has been restricted to require that the anaerobic fermentation process is to brew beer and has been amended to define the process positively. Support for amended Claim 23 is the same as that for new Claim 33.

Election/Restriction

Claims 5, 7, 16, 18, 26 and 29 to 31 have been cancelled in line with the Examiner's requirement as being non-elected claims.

Rejection under 35 USC 112

In the Office Action, the Examiner rejected Claims 1-4, 6, 8-15, 17, 19-25, 27 and 28 under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. To this end, positive antecedent basis has been introduced to the claims where required by the Examiner.

Rejection under 35 USC 103

In the Office Action, the Examiner rejected Claims 1-4, 6, 8, 12-15, 17 and 19 as being unpatentable over either Dean *et al.*

US-A-4978616 (Dean *et al*) discloses processes and apparatus for cultivating cells, e.g. tissue cultures and fermentations (column 1, lines 17 to 21). Dean *et al* teaches the use of a fluidized bed reactor in continuous cell culture processes, including fermentation processes (see column 5, lines 55 to 56).

In general, Dean *et al* discloses the use of a fluidized bed reactor in which a cell cultivation process is carried out in combination with a treatment zone, separate from the reaction zone, in which a portion of liquid separated from the reactor is treated so as to alter the temperature or composition of the separated liquid (see column 2, lines 60 to 67). The treated liquid is then recirculated to the reaction zone (see column 2, line 67 to column 3, line 1). The invention has specific application in continuous aerobic cell culture processes wherein a bed of relatively fragile porous bio-catalyst beads containing immobilized microorganisms or cells is fluidized with a liquid nutrient medium in a reaction zone. A liquid stream containing unconsumed nutrients and biochemical (metabolic) products is separated from the bio-catalyst beads at one end of the reaction zone and a part of this stream is oxygenated in a separate treatment zone and is recirculated to the other end of the reaction zone for fluidizing the bio-catalyst beads (see column 3, lines 3 to 30).

In the exemplified embodiment in Figure 4, a multi-cell fluidized bed reactor is made up of a serial arrangement of individual reactors 100. Culture liquid circulates up through the bed of bio-catalyst beads 136 and down the outside of the reactor bed. A portion 160 of the liquid medium is removed from the reactor and divided into two streams. A product stream 170 is removed and the remaining part of stream 160 is fed to a membrane gas exchanger 130 whereupon the culture liquid is aerated and/or carbon dioxide is extracted therefrom (column 8, lines 19 to 22). The treated liquid is then recirculated to the reaction zone via stream 162.

The closest prior art in this disclosure is the process disclosed as Example 2. In this Example, a fluidized bed bioreactor is prepared in which the beads are made from a hydrocolloid matrix weighted with k-carrageeman and silica powder. Live recombinant yeast cells of *S.cerevisiae* is immobilized therein. A liquid medium containing glucose and other nutrients employed in this type of aerobic fermentation process was pumped into the bioreactor, thereby fluidizing the bed of bio-catalyst beads. In order to oxygenate the bioreactor, the recirculation liquid was passed through a silicone membrane oxygenator wherein high purity oxygen was used as the oxygen source. Carbon dioxide was removed through the silicone membrane simultaneously with oxygenation. The bioreactor was operated continuously to

produce a product stream containing approximately 100 nanograms per millilitre of alpha human chorionic gonadatropin (α-HCG).

Dean *et al* mentions (see column 8, lines 64 to 65) that aerobic and anaerobic processes are contemplated (specifically, in respect of the embodiment depicted in Figure 5) and that, in the broad practice of the invention, any of a wide variety of normally gaseous constituents may be added to, or removed from the recirculating liquid by properly selecting the membrane material... and that this aspect of the invention need not be limited solely to aerobic processes (see column 15, lines 29 to 35).

In contrast, the new claims of the present application have been restricted to a process for brewing beer comprising fermenting **anaerobically** a broth using yeast to convert sugar into water **ethanol** and carbon dioxide. There is no disclosure of any anaerobic fermentation process, let alone such a process for producing beer. Therefore, the present invention is novel over Dean *et al*.

The person to whom the present application is addressed is the person skilled in the art of brewing. The problem that faced the skilled person at the priority date of the present application was how to reduce or eliminate problematic foaming during beer brewing. In contrast, Dean *et al* is directed exclusively towards processes for the (aerobic) cultivation of cells using a fluidized bed reactor. Whilst Dean *et al* mentions that anaerobic processes were contemplated, it does not provide any indication as to exactly how the fluidized bed reactors for aerobic processes could be adapted to carry out anaerobic fermentation processes to produce beer.

There is a clear contraindication in Dean *et al* that the fluidized bed process would be wholly unsuitable for brewing beer. By definition, in a fluidized bed process, the liquid medium is agitated. However, the introduction of the present application states (at page 5, lines 16 and 17) that during the bulk of the fermentation process, the broth is left unagitated as this helps maintain the anaerobic conditions.

With these points in mind, the skilled person would not consider Dean *et al* when faced with the problem of reducing or eliminating foaming during anaerobic fermentation to produce beer. In the unlikely event that Dean *et al* were to be considered, there is no suggestion in this disclosure that would prompt the skilled person to consider modifying an aerobic cell cultivation process using a fluidized bed disclosed in Dean *e al* to produce an anaerobic fermentation process that does not use a fluidized bed (but which produces beer) falling within the scope of the new claims. Therefore, the process as defined by the new claims has an inventive step over Dean *et al*. It necessarily follows that the subsidiary claims dependent from the inventive independent claims are also inventive over Dean *et al*.

Additional Art Comments

Applicant would like to draw the Examiner's attention to art that has been cited in the search report for the corresponding European patent application No. 01305081.0. An IDS accompanies this amendment.

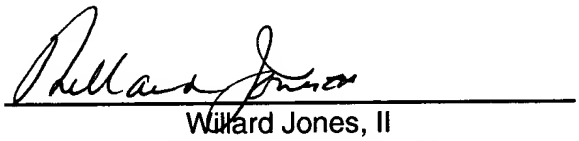
Both WO-A-00/78916 and EP-A-1046706 have been cited as intervening publications in the search report for the European application as their priority/filing dates are earlier than the priority date for the European application but their publication dates are later than until after the priority date. EP-A-1046706 formed the basis of a claim to priority in international patent application No. PCT/EP00/03631 published as WO-A-00/65023. Copies of these references are enclosed herewith for your convenience. The publication dates of all of these references are after the priority date for the subject application.

Both WO-A-00/78916 and WO-A-00/65023 were published in English although the corresponding application for each publication claims priority from a non-US national application. Applicant has been unable to determine whether the US national phase of these international applications has been entered.

Conclusion

In view of the foregoing amendments and remarks, Applicants respectfully submit that the claims are now in condition for allowance. Further examination, and reconsideration and withdrawal of all outstanding rejections, is respectfully requested, and the Examiner is encouraged to issue a formal Notification of Allowance.

Respectfully submitted,



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